

Schem. 6.
Fig. 3.

And that this is true, not onely in one, but in every Ray that goes to the constitution of the Primary Iris; nay, in every Ray, that suffers only two refractions, and one reflection, by the surface of the round body, we shall presently see most evident, if we repeat the *Cartesian Scheme*, mentioned in the tenth *Section* of the eighth *Chapter* of his *Meteors*, where E F K N P in the third Figure is one of the Rays of the Primary Iris, twice refracted at F and N, and once reflected at K by the surface of the Water-ball. For, first it is evident, that K F and K N are equal, because K N being the reflected part of K F they have both the same inclination on the surface K that is the angles F K T, and N K V made by the two Rays and the Tangent of K are equal, which is evident by the Laws of reflection; whence it will follow also, that K N has the same inclination on the surface N, or the Tangent of it X N that the Ray K F has to the surface F, or the Tangent of it F Y, whence it must necessarily follow, that the refractions at F and N are equal, that is, K F E and K N P are equal. Now, that the surface N is by the reflection at K made parallel to the surface at F, is evident from the principles of reflection; for reflection being nothing but an inverting of the Rays, if we re-invert the Ray K N P, and make the same inclinations below the line T K V that it has above, it will be most evident, that K H the inverse of K N will be the continuation of the line F K, and that L H I the inverse of O X is parallel to F Y. And H M the inverse of N P is Parallel to E F for the angle K H I is equal to K N O which is equal to K F Y, and the angle K H M is equal to K N P which is equal to K F E which was to be prov'd.

So that according to the above mentioned *Cartesian* principles there should be generated no colour at all in a Ball of Water or Glas by two refractions and one reflection, which does hold most true indeed, if the surfaces be plain, as may be experimented with any kind of prisme where the two refracting surfaces are equally inclin'd to the reflecting; but in this the *Phænomena* are quite otherwise.

The cause therefore of the generation of colour must not be what *Des Cartes* assigns, namely, a certain *rotation* of the *Globuli ætherei*, which are the particles which he supposes to constitute the *Pellucid medium*, But somewhat else, perhaps what we have lately supposed, and shall by and by further prosecute and explain.

But, First I shall crave leave to propound some other difficulties of his, notwithstanding exceedingly ingenious *Hypothesis*, which I plainly confess to me seem such; and those are,

First, if that light be (as is affirmed, *Diopt. cap. 1. §. 8.*) not so properly a motion, as an action or propension to motion, I cannot conceive how the eye can come to be sensible of the *verticity* of a *Globule*, which is generated in a drop of Rain, perhaps a mile off from it. For that *Globule* is not carry'd to the eye according to his formerly recited Principle; and if not so, I cannot conceive how it can communicate its *rotation*, or circular motion to the line of the *Globules* between the drop and the eye. It cannot be by means of every ones turning the next before him; for if so, then onely all the *Globules* that are in the odd places must be turned the same way

way with the first, namely, the 3. 5. 7. 9. 11, &c. interposited between them in the even places; names must be the quite contrary; whence, according to this there must be no distinct colour generated, but a colour the *Cartesian Globuli* are suppos'd (*Principiorum Philosophiæ*) to be each of them continually in motion about the eye, I cannot conceive how the eye is able to distinguish this new colour from their former inherent one, if I may so call that one, which is mov'd or *turbinated*, from some other cause than their own motion. And thirdly, I cannot conceive how these motions should sometimes to oppose each other, and then, instead of a *rotation*, be nothing but a direct motion generated, and continued. And fourthly, I cannot conceive, how by the *Cartesian Hypothesis* it is possible to give any plausible reason of the nature of the colours in the thin *lamine* of these our *Microscopical Observations*. In these, the refracting and reflecting surfaces are parallel, and consequently no *rotation* can be generated, nor is there a shadow or termination of the bright Rays, such as is mentioned in §. 5. *Et præterea observavi umbram quoque, aut limitationem* (in *Chap. 8. §. 9.*) to be necessary to the generation of colours; Besides that, here is oftentimes one colour generated, and the other appendant ones, which cannot be but by some other *pothefis*.

There must be therefore some other propriety of the generation of colour. And upon the examination of the thing, I conceive one more general, inseparable, and sufficient, than that which is before assign'd. That we may therefore see how exactly this agrees also with the *Phænomena* of the refracting round *Globe* or *Cylinder*, we shall next subjoyn our Calculation of it.

And to this end, we will calculate any two Rays: Let E F be a Ray cutting the *Radius* C D (divided into 1000 parts distant from C, and e f another Ray, which cuts the *Radius* in g 17. parts distant, these will be refracted to K and reflected to N and n, and from thence refracted towards the Arch F f will be 5.^d 5'. The Arch F K 106.^d 2'. The line F G 6000. and f g 5267. therefore F c 980, almost. The line F K 16024. and f k 15436. and n o 147 almost, the line N n 1019 the Arch N n the Angle N n o is 34.^d 43'. therefore the Angle N o p which is almost 50.^d more than a right Angle.

It is evident therefore by this *Hypothesis*, that at the time the Ray touches f. E F is arrived at c. And by that time the Ray E F K N is got to d, and when it touches N, the point n is got to o, and no farther, which is very short of the distance arriv'd to, to make the Ray n p to cut the orbicular surface: therefore the Angle N o p is an acute Angle.